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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Conover, *et al.*	
Serial No:	09/761,514	Group: 1725
Filed:	01/16/2001	Examiner: Kerns, Kevin P.
For:	Optical Component Installation and Train Alignment Process Utilizing Metrology and Plastic Deformation	

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AMENDMENT UNDER RULE 111

Assistant Commission for Patents
Washington, D.C. 20231

Sir:

In response to the pending Office Action, mailed June 5, 2002 (Paper No. 5), Applicants hereby amend the above-captioned application and request reconsideration in view of the following remarks.

In the Specification:

Replace the paragraph beginning at page 2, line 10, in the specification as originally filed, with the following rewritten paragraph:

A1

-- In the example of a tunable filter system, light, typically provided by fiber, is supplied to an optical train, including a tunable filter, such as a Fabry-Perot (FP) tunable filter. The launch characteristics of the light into the FP filter cavity determine the side mode suppression ratio (SMSR) of the system. This ratio, in part, dictates the quality of the system. If light is launched into the filter at the wrong position or with the wrong spot size, higher order modes are excited in the filter, degrading the system's SMSR. Typically, filter train alignment is employed to extract the highest possible SMSR. --

6 October 2002
Application No.:09/761,514
Docket: 1064.us

Replace the paragraph beginning at page 3, line 20, in the specification as originally filed, with the following rewritten paragraph:

A2

-- In such optical systems, the alignment tolerances are more rigorous than that which can be obtained with conventional passive alignment techniques, especially when constructing optical systems with higher levels of integration. As a result, active alignment can be required. Active alignment, however, can be a slow process, especially when the initial alignment of the optical train is poor. --

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Replace the paragraph beginning at page 3, line 25, in the specification as originally filed, with the following rewritten paragraph:

A3

--The present invention is directed to a micro-optical train manufacturing process, in which the positions of optical components on an optical bench are characterized, typically using metrology systems. These optical components are then aligned with respect to each other in a passive alignment step based on data from the metrology system and system design information. As a result, a subsequent active alignment process can be avoided in some situations, or if a subsequent active alignment process is performed, the time required for that active alignment process can be reduced because of this metrology-based passive alignment step. --

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Replace the paragraph beginning at page 5, line 3, in the specification as originally filed, with the following rewritten paragraph:

A4

--In the typical implementation, the optical elements are installed on the optical bench in a relatively fast, but relatively low precision, installation process. Specifically, the optical components are installed on the optical bench to a precision of less than one micrometer, such as within 10 micrometers of their optimal location. Typically, with solder bonding techniques, positions of the optical components can shift by approximately 4 micrometers, in some instances. --

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Replace the paragraph beginning at page 5, line 17, in the specification as originally filed, with the following rewritten paragraph:

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A5

-- Thereafter, an active alignment step is performed, in one implementation, in which an optical signal is transmitted through the optical train and the optical components are then further aligned based upon the transmission characteristics of this optical signal in the optical train. For example, in one implementation, the magnitude of the optical signal transmitted through the optical train is used as the metric for driving the active alignment of the components. In alternative embodiments, a side mode suppression ratio of the filter train, such as in the case of a filter train including a tunable filter, is used as the alignment metric. Again, this final active alignment is performed by plastically deforming the optical elements, in a current implementation. --

Replace the paragraph beginning at page 8, line 6, in the specification as originally filed, with the following rewritten paragraph:

A6

-- After jig pre-assembly, the optical components are inserted into a solder reflow oven (SRO) to reflow the solder and bond the optical elements 110 to the mounting structures 112 to form the optical components 114. --

Replace the paragraph beginning at page 10, line 1, in the specification as originally filed, with the following rewritten paragraph:

A7

-- Fig. 4B shows the location of the mounting structure by the metrology system 220. Specifically, the mounting structure is located by reference to alignment features of the mounting structure--in this case a midpoint 410 between edges 116-1, 116-2. Also shown are the x-axis position 414 and y-axis position 412 of the optical axis oa of the optical component of mounting structure 112. This process yields the component metrology data 310, which characterize the relationship between the position of the optical axis oa of the optical element 110, for example, and alignment marks or features of the mounting structure 112. --

Replace the paragraph beginning at page 10, line 12, in the specification as originally filed, with the following rewritten paragraph:

A8

-- Presently, one of two assembly modalities is used. In one example, a bench jig 140 is used to locate the optical components 114 on the optical bench 130. These assembled benches are then placed in a solder reflow oven 122 to reflow solder between

A8 the optical components and the benches to permanently affix the optical components 114 to the benches 130. --

Replace the paragraph beginning at page 11, line 3, in the specification as originally filed, with the following rewritten paragraph:

A9 -- Fig. 6 shows an exemplary populated bench that results from the bench assembly step 230 of Fig. 1. In this example, optical components including optical fiber components 114-1, including optical fiber F and an associated mounting structure, lens components 114-2, including lens optical elements 54 and lens mounting structures, tunable filter optical components 114-3, detectors 114-5, active laser components 114-8, and passive filters 114-6 are installed to form the populated bench 131. --

Replace the paragraph beginning at page 11, line 15, in the specification as originally filed, with the following rewritten paragraph:

A10 -- Returning to Fig. 1, a bench metrology step 240 is performed using a metrology system 220. Typically, the locations of the optical components 114, and specifically the mounting structures, relative to the bench 130 are measured. This yields bench metrology data 330 that characterize the positions of the optical components relative to alignment features of the optical bench. --

Replace the paragraph beginning at page 11, line 26, in the specification as originally filed, with the following rewritten paragraph:

A11 --The following table illustrates an example of bench metrology data 330. Specifically, the x and y axis positions of a fiber mounting structure (MS), along with a lens mounting structure are determined in a coordinate system of the bench. Data column T1 represents data acquired by the metrology system 240, including component angle data. The target column is the desired position as dictated by the optical system design. Column Dtarget represents the difference between the target data and measured data. The final lens adj column includes data 310. --

Replace the paragraph beginning at page 12, line 13, in the specification as originally filed, with the following rewritten paragraph: